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PATENT
Expedited Procedure
After Final Response
Under 37 CFR 1.116

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

In re application of	)	
	)	Examiner R. Perez Gutierrez
HAYEK ET AL.	)	
	)	Art Unit 2683
Appl. No.: 09/998,489	)	
	)	
Confrim. No. 6375	)	
	)	
Filed: 30 November 2001	)	Atty. Docket No. CS11336

Title: "RF Receivers And Methods"

BRIEF UNDER 37 C.F.R. § 1.192(c)

Assistant Commissioner for Patents
Alexandria, VA 22313

Sir:

Real Party In Interest

The real party in interest is Motorola Inc., by virtue of an assignment duly executed by the named inventor(s) and recorded in the Patent Office on 30 November 2001, REEL/FRAME 012345/0100.

Related Appeals & Interferences

There are no related appeals or interferences.

Claim Status

Original Claims 1-10 stand allowed. Claims 12 was indicated as being allowable but stands objected to for dependence on a rejected claim.

Claims 11 and 13-25 stand rejected.

The appealed claims are Claims 11 and 13-25.

A copy of the claims is appended to the Brief.

Status of Amendments

The title was amended, as requested by the Examiner, in an after final response under 37 CFR 1.116 transmitted on or about 24 June 2004. The Applicants have not yet received an Official Advisory Action or other indication regarding the status of the response under 37 CFR 1.116.

Summary of Disclosure

The inventions are drawn generally to methods and apparatuses in radio receivers, for example, in intermediate frequency and direct conversion receivers. In one embodiment, a mixer injection frequency is provided by dividing a voltage controlled oscillator output by a frequency divide ratio, wherein the voltage controlled oscillator has a frequency outside a bandwidth of received signal harmonics. In another embodiment, a received signal is mixed at a mixer injection frequency outside a passband of a pre-selection filter, and the received signal is chopped before and after mixing at the same chopper frequency, wherein the chopper frequency is proportional to

the mixer injection frequency. In another embodiment, a received signal is mixed after chopping at a mixer injection frequency, wherein the mixer injection frequency is derived from a voltage controlled oscillator signal frequency outside a bandwidth of received signal harmonics. In yet another embodiment, a received signal is mixed at a mixer injection frequency outside a passband of a pre-selection filter, and the received signal is chopped at a chopper frequency proportional to the mixer injection frequency. These and other aspects of the invention are disclosed more fully on page 3, line 5 – page 16, line 2 of the instant patent specification.

Issues for Consideration on Appeal

1. Whether Claims 11, 13, 14, 18 & 24 are patentable over U.S. Publication No. 2001/0039182 (Atkinson) under 35 U.S.C. 103(a).

2. Whether Claims 15-17 are patentable over of US Patent No. 6,487,419 (Freed) under 35 USC 103(a).

3. Whether Claims 19 & 25 are patentable over US Patent No. 6,192,225 (Arpaia) under 35 USC 103(a).

4. Whether Claims 20 and 21 are patentable over Arpaia in view of Freed under 35 USC 103(a).

5. Whether Claims 22 and 23 are patentable over Arpaia in view of Atkinson under 35 USC 103(a).

Grouping of Claims

Claims 11-25 do not stand or fall together. The independent grounds for patentability of Claims 11-23 is fully discussed below.

Discussion of Issue 1

Rejection Summary

Claims 11, 13, 14, 18 & 24 stand rejected Under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Appl. Pub. No. 2001/0039182 (Atkinson).

Regarding Claims 11 and 24, in the Office Action of 18 May 2004, the Examiner alleges specifically that Atkinson discloses

> ... providing a local oscillator signal 24 (mixer injection frequency) (figure 2) by dividing a voltage controlled oscillator (VCO) 38 output by a frequency divide ratio (figure 2 and page 2 paragraphs 0018 and 0019),
> the VCO 38 having a frequency F3 outside a bandwidth of received signal harmonics (figure 2 and page 2 paragraph 0020).

Regarding Claims 13, 14 and 18, in the Office Action of 18 May 2004, the Examiner contends that it would have been obvious to

> ... modify the teaching of Atkinson to specifically select a frequency divide ratio greater or equal to one that would have maintained the local oscillator frequency outside the bandwidth of harmonics or fundamental frequency of the received signal in order to prevent leakage of the local oscillator frequency.

Allowability of Claim 11

Regarding Claim 11, contrary to the Examiner's assertion, Atkinson fails to disclose or suggest a

> ... method in intermediate frequency and direct conversion receivers, comprising:
>
> providing a mixer injection frequency by dividing a voltage controlled oscillator output by a frequency divide ratio,
>
> the voltage controlled oscillator having a frequency outside a bandwidth of received signal harmonics.

Atkinson is silent on the relationship between the VCO frequency and the bandwidth of received signal harmonics. The Examiner's assertion otherwise is not support by the prior art. At para. [0020] (referenced by the Examiner), Atkinson discloses that

> ... [t]he frequency of the F_3 of the signal from the voltage controlled oscillator is ... not harmonically related ... to the frequency of the in RF signal ... because the frequency of the input RF signal is equal to $^4/_3$ F_3.

In Atkinson, the VCO frequency may be within or without the received signal harmonics. That the VCO frequency of Atkinson is not harmonically related to the frequency of the RF input signal indicates nothing about the relationship between the VCO frequency and the "... bandwidth of received signal harmonics" as recited in Claim 11. Independent Claim 11 and dependent Claims 12-18 are thus patentably distinguished over Atkinson.

Allowability of Claim 13

Regarding Claim 13, contrary to the Examiner's assertion, Atkinson does not disclose or suggest, in combination with the limitations of Claim 11,

> ... the frequency divide ratio is q = 1, mixing the received signal at a mixer injection frequency outside a bandwidth of a fundamental frequency of the received signal.

According to Atkinson, at para. [0020], "... [t]he frequency of the F_3 of the signal from the voltage controlled oscillator is ... not harmonically related ... to the frequency of the in RF signal ... because the frequency of the input RF signal is equal to $4/3$ F_3." In Atkinson. if the divide ratio = 1, the VCO 38 frequency F_3 would be equal to the frequency of the input RF signal, contrary to the teaching of Atkinson. Thus Atkinson does not suggest that the "... frequency divide ratio q = 1 ..." as in Claim 13. Claim 13 is thus further patentably distinguished over Atkinson.

Allowability of Claim 14

Regarding Claim 14, contrary to the Examiner's assertion, Atkinson dose not disclose or suggest, in combination with the limitations of Claim 11,

> ... mixing the received signal at a mixer injection frequency derived from a VCO frequency that is outside a bandwidth of the n^{th} harmonic of the received signal, where the frequency divide ratio q equals the harmonic number n.

The Examiner's action does not expressly address the limitations of Claim 14. In Atkinson, the frequency divide ratio in Atkinson is < 1, since Atkinson multiples the VCO frequency F_3 by $4/3$. Atkinson nevertheless makes no reference to a relation between the frequency divide ratio and harmonic number. Claim 14 is thus further patentably distinguished over Atkinson.

Allowability of Claim 18

Regarding Claim 18, contrary to the Examiner's assertion, Atkinson fails to disclose or suggest, in combination with the limitations of Claim 11,

> ... mixing the received signal at a mixer injection frequency outside a channel bandwidth of the received signal.

Atkinson merely provides a VCO frequency that is not harmonically related to the frequency of the input RF signal, without regard to whether or not the mixer injection frequency is outside the "channel bandwidth" of the received signal. Claim 18 is thus further patentably distinguished over Atkinson.

Discussion of Independent Claim 24

Atkinson fails to disclose or suggest a method in intermediate frequency and direct conversion receivers, comprising:

> ... providing a mixer injection frequency at a frequency different than the receive frequency by dividing a voltage controlled oscillator output by a frequency divide ratio,
> the voltage controlled oscillator having a frequency outside a bandwidth of received signal harmonics.

In Atkinson, the mixer injection frequency (34) is the same as the received signal frequency. Atkinson, para. [0019]. As noted above, Atkinson is silent on the relationship between the VCO frequency and the bandwidth of received signal harmonics. The Examiner's assertion otherwise is not support

by the prior art. In Atkinson, the VCO frequency may be within or without the received signal harmonics. That the VCO frequency of Atkinson is not harmonically related to the frequency of the RF input signal indicates nothing about the relationship between the frequency of the voltage controlled oscillator and the "... bandwidth of received signal harmonics" as recited in Claim 24. Claim 24 is thus patentably distinguished over Atkinson.

Discussion of Issue 2

Rejection Summary

Claims 15-17 stand rejected under 35 USC 103 as being unpatentable over Atkinson in view of US Patent No. 6,487,419 (Freed).

The Examiner concedes that Atkinson fails to disclose "... determining the signal strength and bit error rate of the received signal and increasing a gain of the received signal before mixing if the gain of the signal received signal is below a gain threshold". The Examiner asserts however that these actions would have been made obvious in light of the teaching of Freed "... in order to efficiently manage the power consumption of the wireless device." Office Action, 18 May 2004.

Allowability of Claim 15

Regarding Claim 15, Atkinson and Freed do not suggest, in combination with the limitations of Claim 11,

... determining a condition of the received signal;

> mixing the received signal at the mixer injection frequency derived from a VCO frequency that is outside the bandwidth of the harmonics of the received signal only if the condition of the received signal is above a threshold.

Contrary to the Examiner's assertion, neither Atkinson nor Freed disclose or suggest conditional mixing. Examiner's does not specifically address the conditional limitation of Claim 15. Claim 15 is thus further patentably distinguished over Atkinson and Freed.

Allowability of Claim 16

Regarding Claim 16, neither Atkinson nor Freed disclose or suggest, in combination with the limitations of Claim 11,

> ... determining the condition of the received signal by determining a strength thereof.

Contrary to the Examiner's assertion, neither Atkinson nor Freed disclose or suggest conditional mixing, and therefore there is no reason for either reference to suggest "... determining the condition of the received signal..." as recited in Claim 16. Claim 16 is thus patentably distinguished over Atkinson and Freed.

Allowability of Claim 17

Regarding Claim 17, neither Atkinson nor Freed disclose or suggest, in combination with the limitations of Claim 11,

> ... determining the condition of the received signal by determining a signal strength and bit error rate (BER) thereof, increasing a gain of the received signal before mixing if the gain of the received signal is below a gain threshold.

Contrary to the Examiner's assertion, neither Atkinson nor Freed disclose or suggest conditional mixing, and therefore there is no reason for either reference to suggest "... determining the condition of the received signal..." and "... increasing gain ..." as recited in Claim 16. Claim 17 is thus patentably distinguished over Atkinson and Freed.

Discussion of Issue 3

Rejection Summary

Claims 19 & 25 stand rejected under 35 USC 103(a) as being unpatentable over US Patent No. 6,192,225 (Arpaia).

Allowability of Claim 19

Regarding Claim 19, contrary to the Examiner's assertion, Arpaia fails to disclose or suggest a

> ... method in an RF receiver, comprising:
> receiving a signal within a passband of a pre-selection filter of the receiver;
> mixing the received signal at a mixer injection frequency outside the passband of the pre-selection filter;
> chopping the received signal before and after mixing at the same chopper frequency,

the chopper frequency proportional to the mixer injection frequency.

Arpaia does not mix the received signal with "... a mixer injection frequency outside the passband of the pre-selection filter..." In Arpaia, the frequency of the switching oscillator (7) is greater than the bandwidth of the preselector filter. Arpaia, col. 4, lines 47-50 & lines 63- 67. The switching oscillator of Arpaia, controls the chop rate, which is not the same as the mixer injection frequency. In Arpaia, the frequency f_o of the local oscillator (4) (mixer injection frequency) is the same as the carrier frequency of the received signal. Arpaia, col. 4, lines 6-8. Arpaia's disclosure of a frequency greater than the bandwidth of the pre-selection filter is not the same as a "... frequency outside the passband of the pre-selection filter...."

Arpaia also fails to chop the received signal at a "... chopper frequency proportional to the mixer injection frequency." In Arpaia, the inverters 9, 9' "chop up" second order products (harmonics) by switching the polarity of the signal at the same rates as the switching oscillator (9). Arpaia, col. 4, lines 40-44. In Arpaia, the local oscillator (40) and the switching oscillator (7) are separate oscillators, and thus there is no implication that the frequencies thereof are proportional. Claim 19 and dependent Claims 20-21 are therefore patentably distinguished over Arpaia.

Allowability of Claim 25

Regarding independent Claim 25, contrary to the Examiner's assertion, Arpaia fails to disclose or suggest a

... method in an RF receiver, the method comprising:

receiving a signal within a passband of a pre-selection filter of the receiver;

mixing the received signal at a mixer injection frequency outside the passband of the pre-selection filter;

chopping the received signal at a chopper frequency proportional to the mixer injection frequency.

In Arpaia, only the frequency of the switching oscillator (7) is greater than the bandwidth of the preselector filter. Arpaia performs chopping at the same rate as the switching oscillator. Also, in Arpaia, the frequency f_o of the local oscillator (4) (mixer injection frequency) is the same as the carrier frequency of the received signal. Claim 25 is thus patentably distinguished over Arpaia.

Discussion of Issue 4

Rejection Summary

Claims 20 and 21 stand rejected under 35 USC 103 as being unpatentable over Arpaia in view of Freed.

Allowability of Claim 20

Regarding dependent Claim 20, neither Arpaia nor Freed disclose or suggest "... increasing a gain of the received signal before mixing if the received signal gain is below a threshold" in combination with Claim 19. Claim 20 is thus further patentably distinguished over Arpaia and Freed.

Discussion of Claim 21

Regarding Claim 21, neither Arpaia nor Freed disclose or suggest, in combination with the limitations of Claim 19,

> ... mixing the received signal at the mixer injection frequency outside the passband of the pre-selection filter when the measured gain is above a threshold, mixing the received signal at a mixer injection frequency within the passband of the pre-selection filter if the measured gain is below the threshold.

The Examiner does not explicitly address the conditional mixing of the receive signal, which is not addressed by Arpaia or Freed. Nevertheless, neither Arpaia nor Freed disclose or suggest conditional mixing. Claim 21 is thus patentably distinguished over the art.

Discussion of Issue 5

Rejection Summary

Claims 22 and 23 stand rejected Under 35 USC 103(a) as being unpatentable over Arpaia in view of Atkinson. In the Office Action of 18 May 2004, the Examiner alleges specifically that it would have been obvious to

> ... modify the teachings of Arpaia et al, with the teachings of Atkinson to specifically select a frequency divide ratio greater than or equal to one that would have maintained the local oscillator frequency outside the bandwidth of harmonics or fundamental frequency of the received signal ....

Allowability of Claim 22

Regarding independent Claim 22, contrary to the Examiner's assertion, neither Atkinson nor Arpaia disclose or suggest a

> ... method in intermediate frequency and direct conversion receivers, comprising:
> chopping a received signal;
> mixing the received signal after chopping at a mixer injection frequency;
> deriving the mixer injection frequency from a voltage controlled oscillator signal frequency outside a bandwidth of received signal harmonics.

Atkinson multiplies the frequency F_3 of the VCO 38 by a factor of $^4/_3$, which corresponds to a frequency divide ratio in Atkinson that is < 1. See Atkinson, para. [0019]. Also, Atkinson does not distinguish between a VCO having a frequency that is within or without the bandwidth of the received signal harmonics. Atkinson merely indicates that the frequency of the VCO is "... not harmonically related ... to the frequency of the input RF signal." Claim 22 and dependent Claim 23 are thus patentably distinguished over Atkinson and Arpaia.

Discussion of Claim 23

Regarding Claim 23, neither Arpaia nor Atkinson disclose or suggest, in combination with the limitations of Claim 22,

> ... providing the mixer injection frequency derived from a VCO frequency that is outside a bandwidth of the harmonics of the received signal by dividing a voltage controlled oscillator output by a frequency divide ratio,

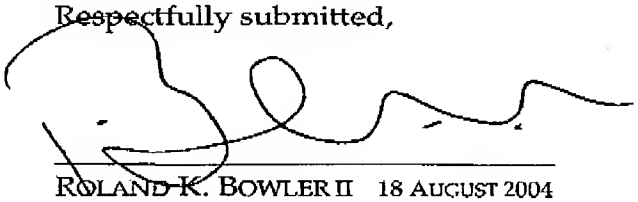
a harmonic of the received signal corresponding to the divide ratio of the frequency divider.

The Examiner's action does not specifically address the limitations of Claim 23. Arpaia and Atkinson nevertheless fails to divide a VCO output by a frequency divider that corresponds to a harmonic of the received signal. Claims 23 is thus patentably distinguished over Arpaia and Atkinson.

Prayer for Relief

Kindly reverse and vacate the rejections of claims, in view of the discussion above, with instructions for the Examiner to allow said Claims to issue in a United States Patent without further delay.

Respectfully submitted,



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Claims On Appeal

1. (Original) A method in intermediate frequency and direct conversion receivers having a pre-selection filter passband, comprising:

mixing a receive signal at a mixer injection frequency outside the pre-selection filter passband,

the mixer injection frequency proportional to a first quantity divided by a second quantity,

the first quantity proportional to a difference between the receive signal frequency and an intermediate frequency, the second quantity proportional to a difference between unity and a quantity proportional to a reciprocal of a chopper divide ratio.

2. (Previously Presented) The method of Claim 1, chopping the receive signal at an input chopper before mixing, chopping the receive signal at an output chopper after mixing, the input and output choppers having a chopper frequency proportional to the mixer injection frequency divided by the chopper divide ratio.

3. (Original) The method of Claim 1, increasing a gain of the receive signal before mixing.

4. (Original) The method of Claim 1,

measuring a condition of the receive signal,

mixing the receive signal at a mixer injection frequency proportional to a difference between the desired signal frequency and an intermediate frequency if the receive signal condition is below a predetermined threshold;

mixing the receive signal at a mixer injection frequency proportional to the first quantity divided by the second quantity if the receive signal condition is above the predetermined threshold.

5. (Original) A method in intermediate frequency and direct conversion receivers having a pre-selection filter passband (BW_{PSF}), comprising:

mixing a receive signal at a mixer having a mixer injection frequency (f_{LO}) proportional to (f_{RX}-/+f_{IF})/(1-/+K_{LO}/NL),

chopping the receive signal with a chopper having a chopper frequency (f_{CHOP}) proportional to (f_{LO}/NL),

where (f_{RX}) is a frequency of the receive signal, (f_{IF}) is an intermediate frequency of the receiver, NL is a divide ratio of the chopper, (K_{LO}) is a VCO proportionality constant divide ratio.

6. (Original) The method of Claim 5, selecting the mixer injection frequency (f_{LO}) so that an absolute value of (f_{RX}-f_{LO}) is greater than the preselection filter passband (BW_{PSF}).

7. (Original) The method of Claim 5, selecting the mixer injection frequency (f_{LO}) so that a VCO frequency, f_{VCO}, is outside a bandwidth of receive signal harmonics.

8. (Original) The method of Claim 5,

measuring a strength of the receive signal,

mixing the receive signal at the mixer having the mixer injection frequency (f_{LO}) proportional to (f_{RX}-/+f_{IF})/(1-/+ K_{LO}/NL) when the receive signal strength is above a predetermined threshold;

mixing the receive signal at a mixer having a mixer injection frequency (f_{LO}) proportional to (f_{RX}-/+f_{IF}) when the receive signal strength is below the predetermined threshold.

9. (Original) The method of Claim 8, chopping the receive signal at an input chopper before mixing, chopping the receive signal at an output chopper after mixing, the input and output choppers having a chopper frequency (f_{CHOP}) proportional to the mixer injection frequency divided by the chopper divide ratio (f_{LO}/NL).

10. (Original) The method of Claim 8, increasing a gain of the receive signal before mixing if the receive signal gain is below a threshold.

11. (Original) A method in intermediate frequency and direct conversion receivers, comprising:

receiving a signal;

providing a mixer injection frequency by dividing a voltage controlled oscillator output by a frequency divide ratio,

the voltage controlled oscillator having a frequency outside a bandwidth of received signal harmonics.

12. (Previously Presented) The method of Claim 11,

mixing the received signal at the mixer injection frequency,

the mixer injection frequency proportional to a first quantity divided by a second quantity, the first quantity proportional to a difference between the received signal frequency and an intermediate frequency, the second quantity proportional to a difference between unity and a quantity proportional to a reciprocal of a chopper divide ratio;

chopping the received signal at a chopper frequency proportional to the mixer injection frequency divided by the chopper divide ratio.

13. (Original) The method of Claim 11, the frequency divide ratio is $q = 1$, mixing the received signal at a mixer injection frequency outside a bandwidth of a fundamental frequency of the received signal.

14. (Original) The method of Claim 11, the frequency divide ratio is $q > 1$, mixing the received signal at a mixer injection frequency derived from

a VCO frequency that is outside a bandwidth of the n^{th} harmonic of the received signal, where the frequency divide ratio q equals the harmonic number n.

15. (Original) The method of Claim 11,

determining a condition of the received signal;

mixing the received signal at the mixer injection frequency derived from a VCO frequency that is outside the bandwidth of the harmonics of the received signal only if the condition of the received signal is above a threshold.

16. (Original) The method of Claim 15, determining the condition of the received signal by determining a strength thereof.

17. (Previously Presented) The method of Claim 15, determining the condition of the received signal by determining a signal strength and bit error rate (BER) thereof, increasing a gain of the received signal before mixing if the gain of the received signal is below a gain threshold

18. (Original) The method of Claim 11, mixing the received signal at a mixer injection frequency outside a channel bandwidth of the received signal.

19. (Original) A method in an RF receiver, comprising:

receiving a signal within a passband of a pre-selection filter of the receiver;

mixing the received signal at a mixer injection frequency outside the passband of the pre-selection filter;

chopping the received signal before and after mixing at the same chopper frequency,

the chopper frequency proportional to the mixer injection frequency.

20. (Original) The method of Claim 19, increasing a gain of the received signal before mixing if the received signal gain is below a threshold.

21. (Original) The method of Claim 19, determining a gain of the received signal, mixing the received signal at the mixer injection frequency outside the passband of the pre-selection filter when the measured gain is above a threshold, mixing the received signal at a mixer injection frequency within the passband of the pre-selection filter if the measured gain is below the threshold.

22. (Original) A method in intermediate frequency and direct conversion receivers, comprising:

chopping a received signal;

mixing the received signal after chopping at a mixer injection frequency;

deriving the mixer injection frequency from a voltage controlled oscillator signal frequency outside a bandwidth of received signal harmonics.

23. (Previously Presented) The method of Claim 22,

providing the mixer injection frequency derived from a VCO frequency that is outside a bandwidth of the harmonics of the received signal by dividing a voltage controlled oscillator output by a frequency divide ratio,

a harmonic of the received signal corresponding to the divide ratio of the frequency divider.

24. (Previously Presented) A method in intermediate frequency and direct conversion receivers, comprising:

receiving a signal at a receive frequency;

providing a mixer injection frequency at a frequency different than the receive frequency by dividing a voltage controlled oscillator output by a frequency divide ratio,

the voltage controlled oscillator having a frequency outside a bandwidth of received signal harmonics.

25. (Previously Presented) A method in an RF receiver, the method comprising:

receiving a signal within a passband of a pre-selection filter of the receiver;

mixing the received signal at a mixer injection frequency outside the passband of the pre-selection filter;

chopping the received signal at a chopper frequency proportional to the mixer injection frequency.